Coupling NASA Advanced Multi-Scale Modeling and Concurrent Visualization Systems for Improving Predictions of Tropical High-Impact Weather (CAMVis)

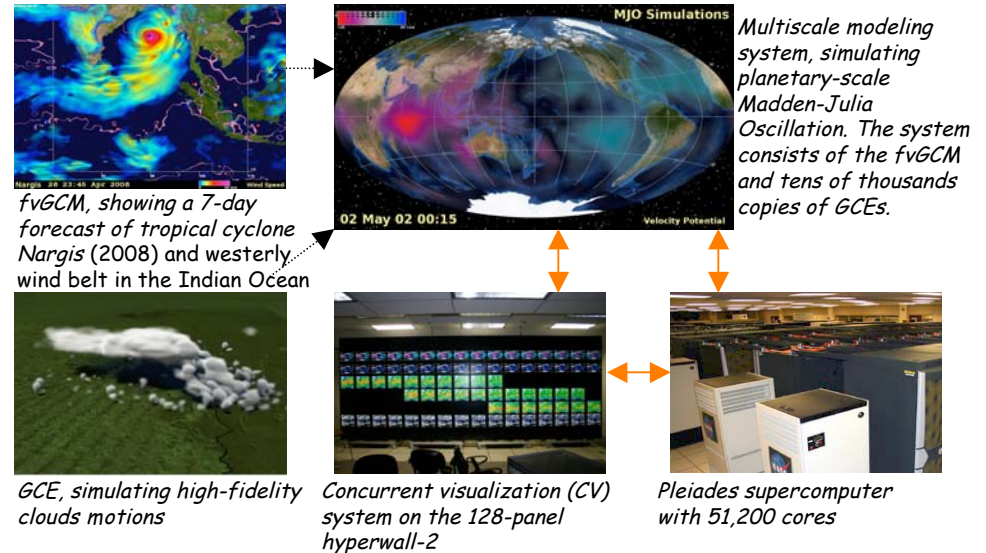## PI: Bo-Wen Shen (UMD/ESSIC)

Objective

Develop CAMVis weather prediction tool to improve predictions of tropical high-impact weather systems. The tool will seamlessly integrate NASA technologies
- Advanced supercomputing
- Concurrent visualization (CV)
- Multi-scale (global-, meso-, cloud-scale) modeling systems

The goal is to improve the understanding of the roles of atmospheric moist thermodynamic processes (i.e., the changes of precipitation, temperature, and humidity) and cloud-radiation-aerosol interactions.

CAMVis supports NRC Decadal Survey Earth Science missions: CLARREO, ACE, PATH, 3D-Winds

fvGCM, showing a 7-day forecast of tropical cyclone Nargis (2008) and westerly wind belt in the Indian Ocean

Multiscale modeling system, simulating planetary-scale Madden-Julia Oscillation. The system consists of the fvGCM and tens of thousands copies of GCEs.

GCE, simulating high-fidelity clouds motions

Concurrent visualization (CV) system on the 128-panel hyperwall-2

Pleiades supercomputer with 51,200 cores

Approach

- Improve parallel scalability of the multi-scale modeling system to take full advantage of the next-generation peta- scale supercomputers (e.g., NASA Pleiades)
- Integrate NASA multi- scale (global, regional, cloud-scale) model system, including Goddard Cloud Ensemble model (GCE) and the finite-volume General Circulation Model (fvGCM), and the concurrent visualization (CV) system
- Significantly streamline data flow for fast pre- and post-processing and visualizations
- Conduct high-resolution numerical simulations and visualizations for high-impact tropical weather events
- Test coupled systems

Co-I's/Partners

- Co-I's: Wei-Kuo Tao (GSFC, CO-PI), Bryan Green (CO-PI), Chris Henze, Piyush Mehrotra, (ARC), Jui-Lin Li (JPL)
- Partners: Antonio Busalacchi (UMD), Peggy Li (JPL)

Key Milestones

- Implement (update) model components and CV on the Pleiades (Columbia) supercomputer; Conduct initial benchmarks — 09/2009
- Improve parallel scalability of model components; Integrate the NASA fvGCM and CV; Develop the super-component mgGCE — 03/2010
- Couple the NASA mgGCE and CV; Implement and test an I/O module — 09/2010
- Integrate the fvMMF (fvGCM+mgGCE) and CV — 03/2011
- Streamline data flow for production runs — 09/2011
- Test the CAMVis system; Produce results — 03/2012

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